A Sustainable Remedy for the Lower Passaic River

Cooperating Parties Group

Sustainable Remedy is Protective

- Consistent with EPA Guidance
  - Sediment Management Principles
  - Uses Adaptive Management to assure success
- Addresses entire river
- Is protective
  - Will Meet Risk Reduction Goals
  - Removes high concentration areas
  - Minimizes re-suspension of COCs
  - Manages interim risks
- NCP Process – Lowest Cost Alternative that is Protective
- Reduces duration/disturbance of River
- Enhances the natural recovery rates of the River

Presentation Elements

- Overview of Sustainable Remedy
- Questions Raised at Last Presentation
  - Mass Removal
  - Engineering Alternatives
  - Modeling Results
  - Risk Reduction
  - Out-of-River Projects
- Addressing Uncertainty

SUSTAINABLE REMEDY OVERVIEW

Goals for the River

- Improve the quality of the River as quickly as possible
- Use techniques that have the best chance for success and have been proven effective
- Use adaptive techniques to address uncertainty
- Minimize impacts and provide value to neighboring communities and watershed

A Sustainable Remedy

- Needs to address the entire 17-mile ecosystem
- Consists of:
  - Targeted remediation of highest surface sediment contamination followed by review of actual, measured results against performance metrics
  - Projects such as wetlands restoration, storm water reduction initiatives and efforts to improve access and usability
- Provides interim and long-term risk reduction

A Sustainable Remedy

- Supported by updated Conceptual Site Model
  - Utilizes all available data from ongoing RI/FS
  - Multiple Lines of Evidence
- Provides an integrated package of risk mitigation technologies
- Specifically addresses uncertainty associated with complex river/estuarine systems

Sustainable Remedy Based on "Adaptive Management"

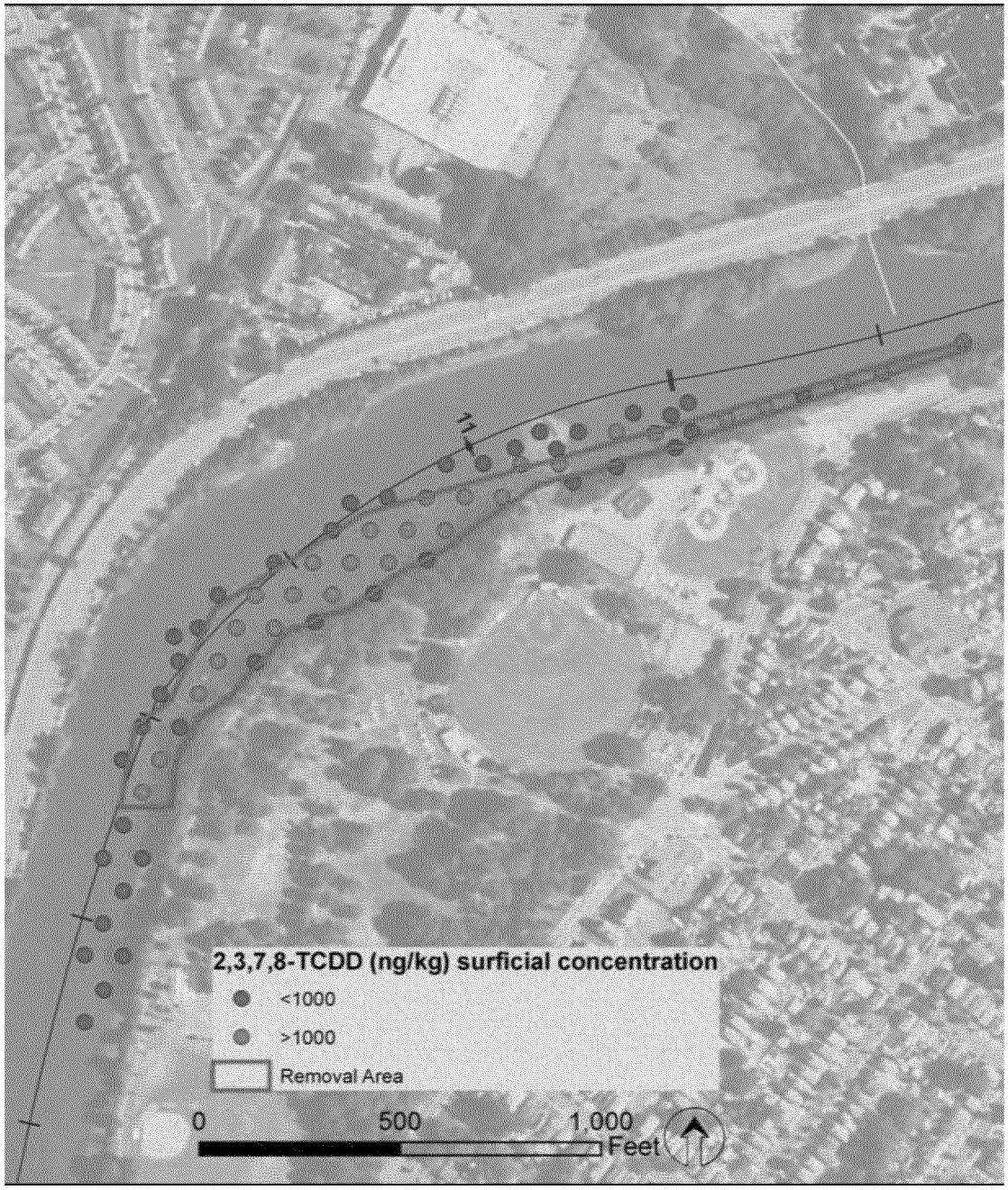
Design

How do you best address uncertainty?

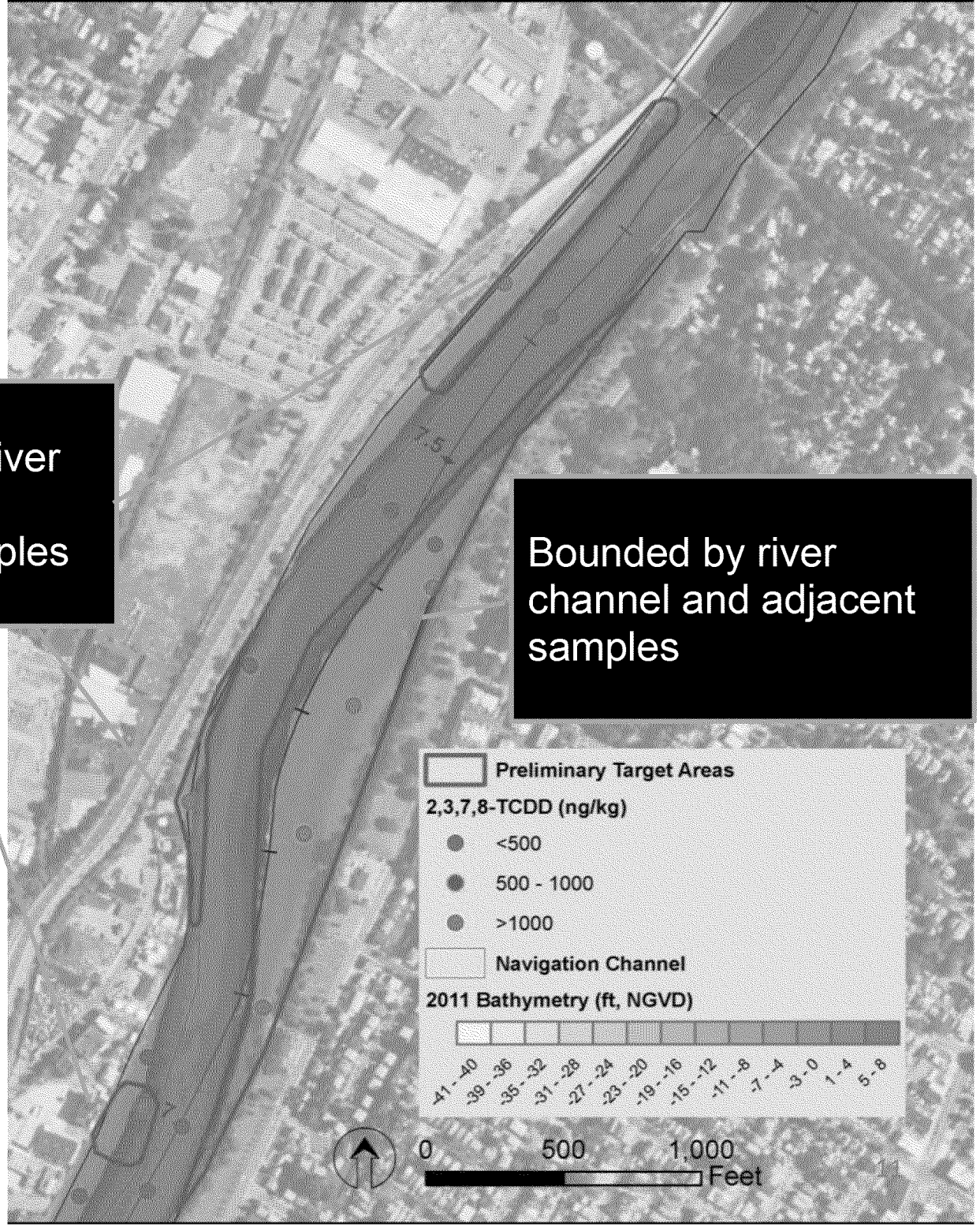
DEVELOPMENT OF TARGET AREAS

RM 10.9 Data Clearly Illustrates Ability to Reduce Potential Risk with Targeted Removal

- 2,3,7,8 TCDD Removal Area is well defined by 1000 ppt contour:
  - In fine sediment near shore in central to upriver portion of inside river bend
  - Rapid decline of concentrations outside of silt deposit
- Deeper sediment is stable as documented by radiodating
- TCDD co-located with other COCs (especially those with the highest concentrations such as PCBs and mercury)
- Targeted remediation of high concentration area provides significant overall risk reduction



Developing Target Areas: Example at RM 7-7.8

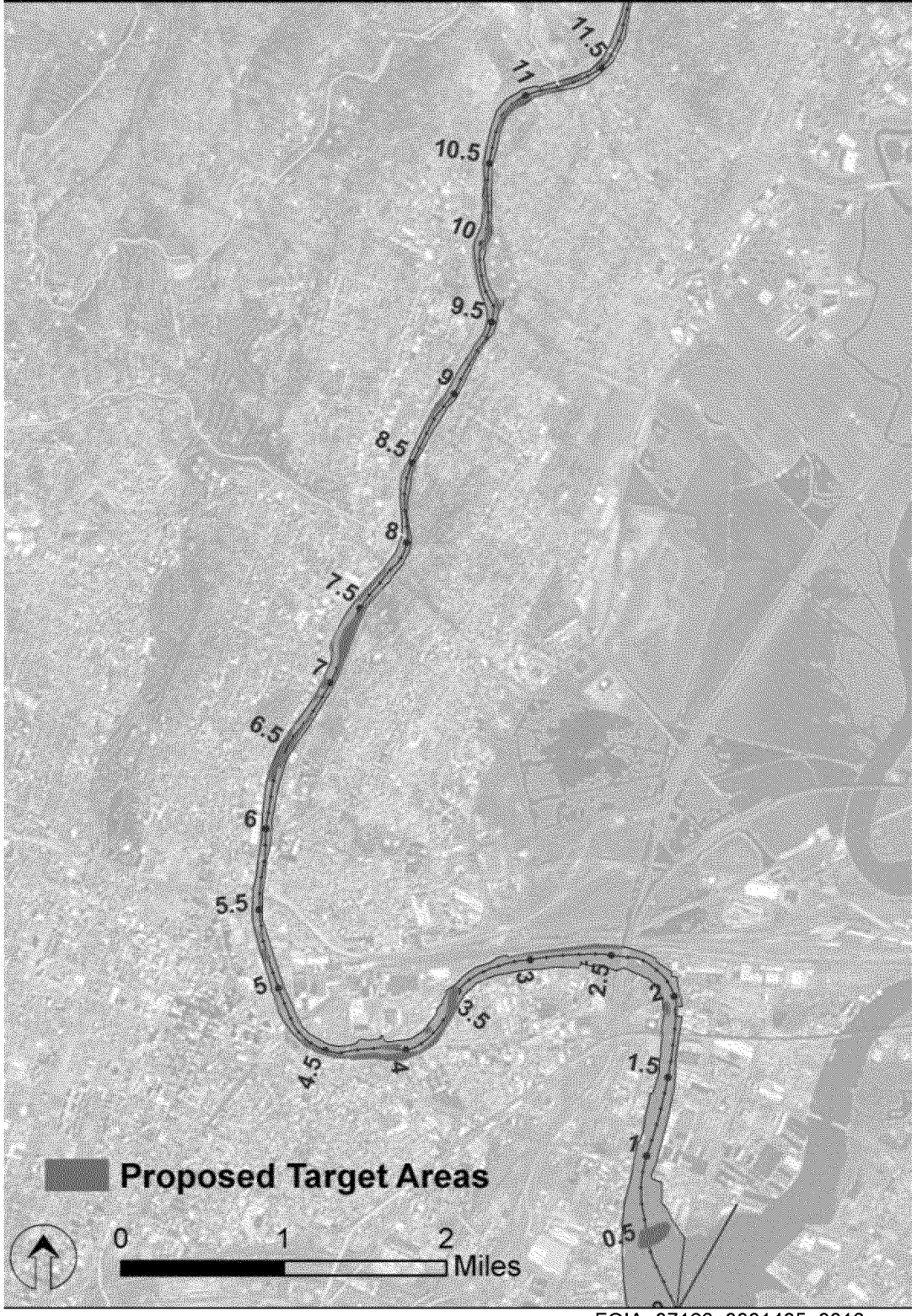


Use of Multiple Lines of Evidence

- Locations selected based on surficial 2,3,7,8-TCDD concentration > 500 ppt
- Delineation of Target Areas based on:
  - Silt deposits (Side-scan survey)
  - Bathymetry
  - Navigation channel
  - Observed erosion (post-Irene)
  - Extrapolation between data points

Proposed Target Areas

- Elevated TCDD and other COCs are generally co-located
- As per Adaptive Management, ongoing delineation and monitoring will be used to refine areas
- Will reduce surface concentrations of TCDDs by 80% and bring PCBs to background levels



MASS REMOVAL

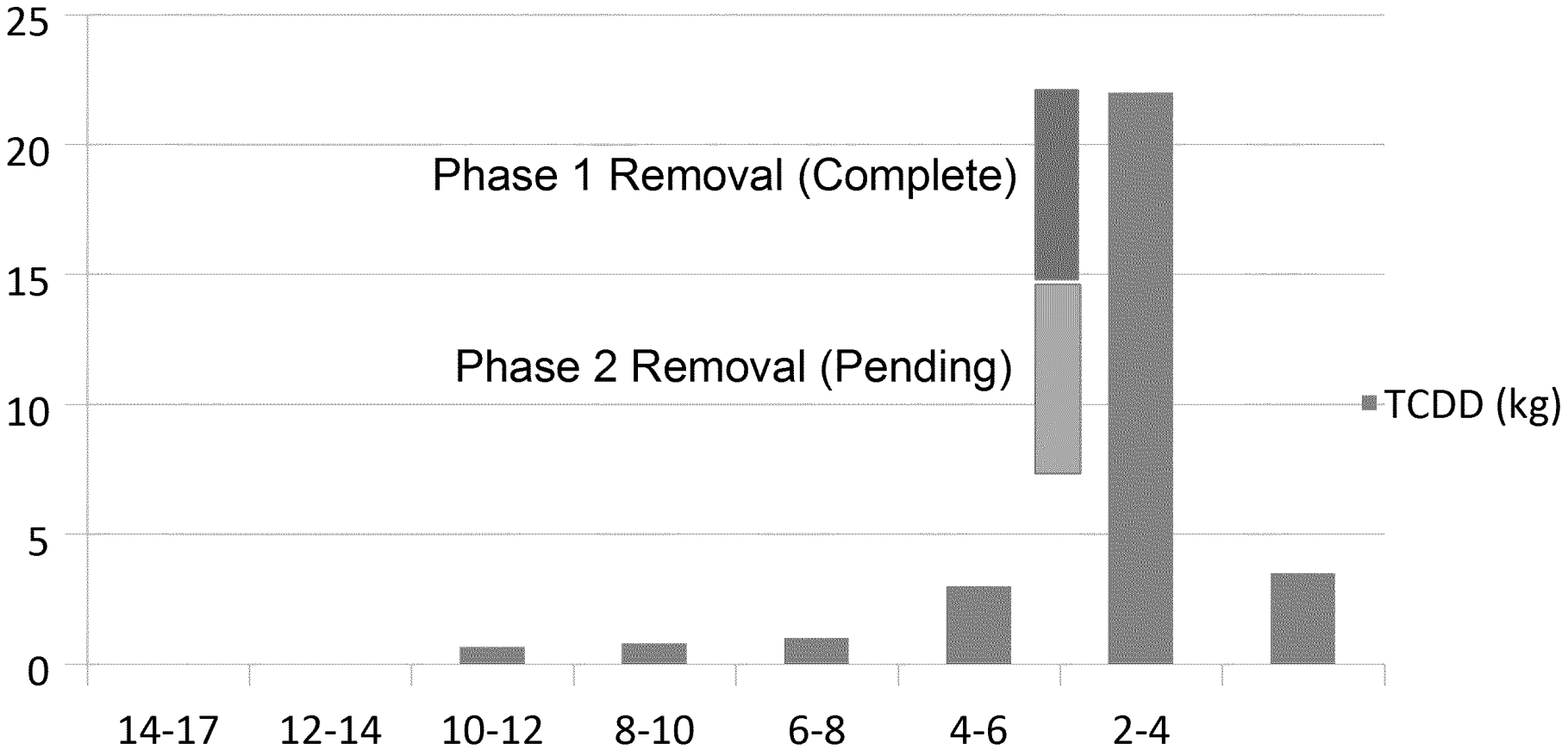
Mass Removal - Issues

- Human Health and Ecological Risks Driven by Surface (0-6”) Concentrations, not by Mass
- In R2’s FFS Analysis, Cap & Dredge is more Protective than Complete Removal
  - Duration
  - Resuspension
  - Increased Human Health Risk
- Observed Consolidation of Sediments at TSI Phase 1 May Further Hinder Removal and Exacerbate Resuspension in Lower Reach of River

Mass Removal - Issues

- It is not axiomatic that mass removal will achieve desired endpoints:
  - New Bedford Harbor
    - 45 % PCB mass removal in 1994-95
    - Caged mussels showed no reduction
  - Grasse River
    - 27% PCB mass removal in 1995
    - Resident fish showed no response

Distribution of TCDD Mass vs. River Mile



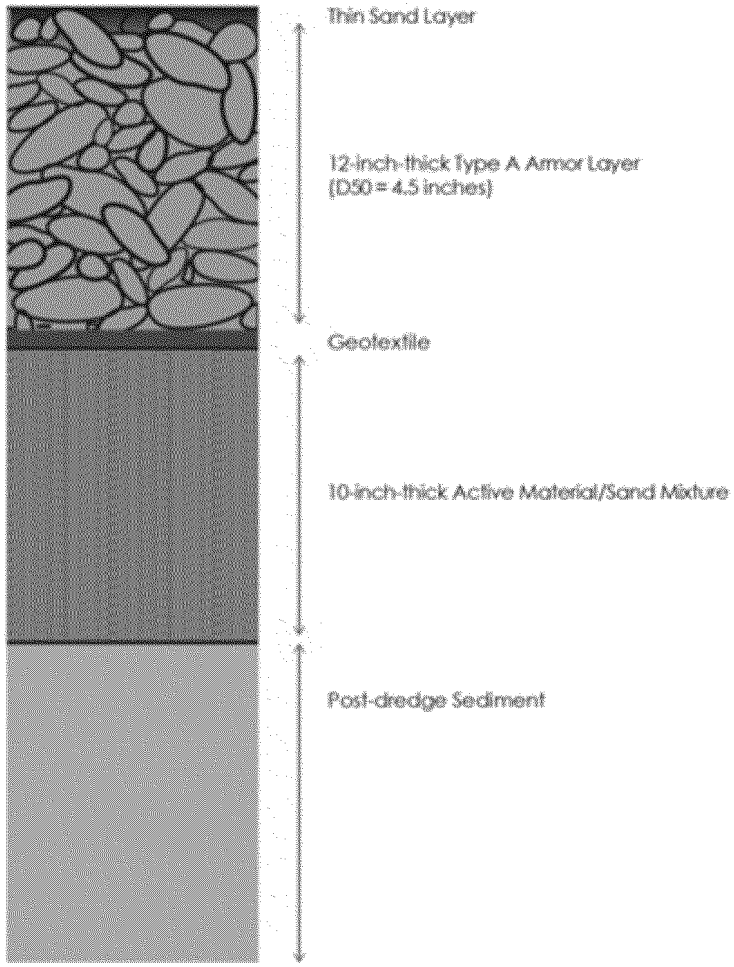
ENGINEERING ALTERNATIVES

Engineering Alternatives

- Sustainable Remedy
  - Utilizes EPA FFS Cap configuration as default
  - Additional analysis will select area-specific configurations
- Alternatives available:
    - Cap placement configurations
    - Bank softening/habitat improvement
    - Cap thickness/armoring
    - Active layers
    - Composite materials

Site Specific Implementation (RM10.9)

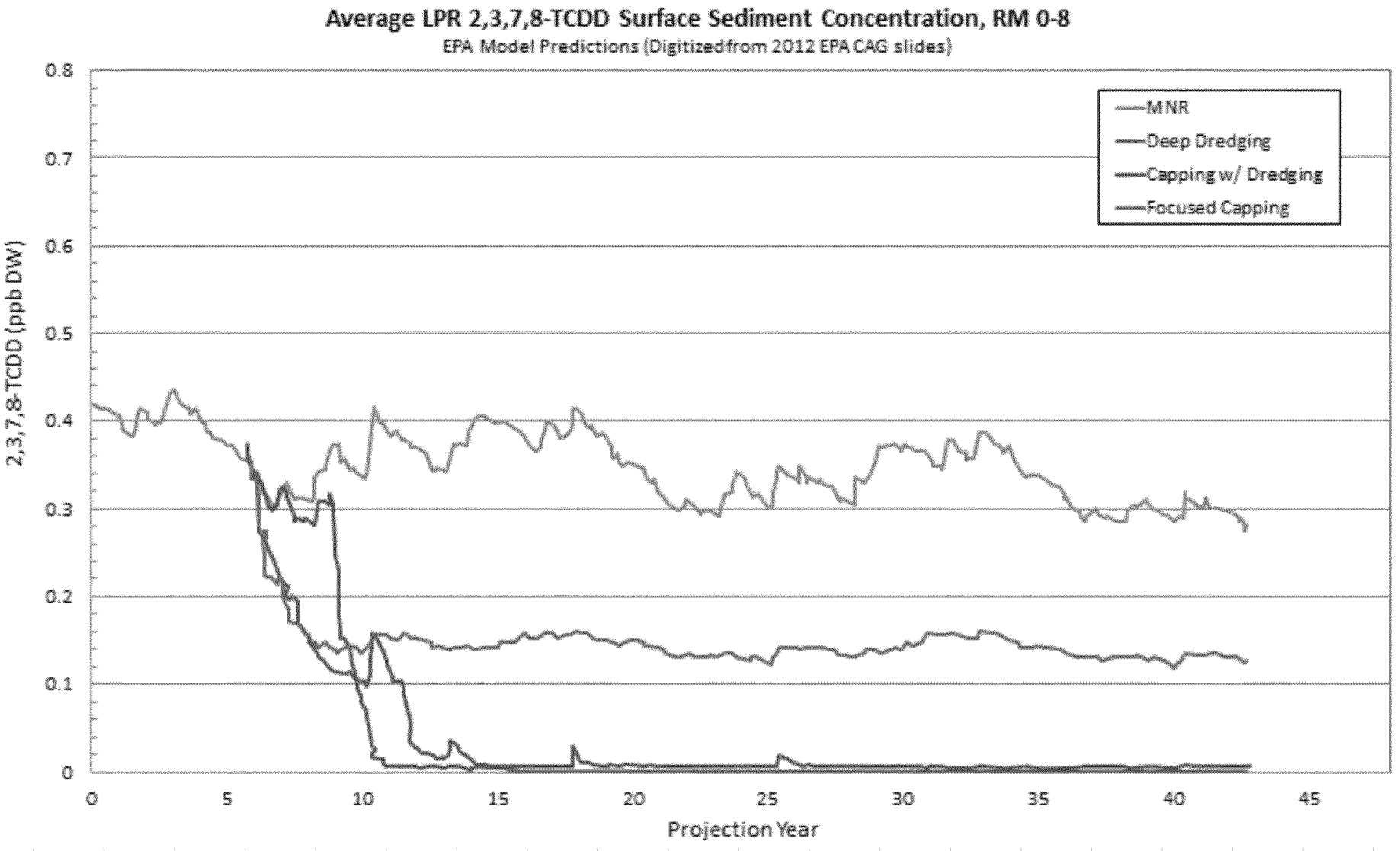
- Cap configuration
- Methodology:
  - Dredging
  - Resuspension Control
- Duration
- State and Local Permitting
- Utility Clearances



MODELING RESULTS

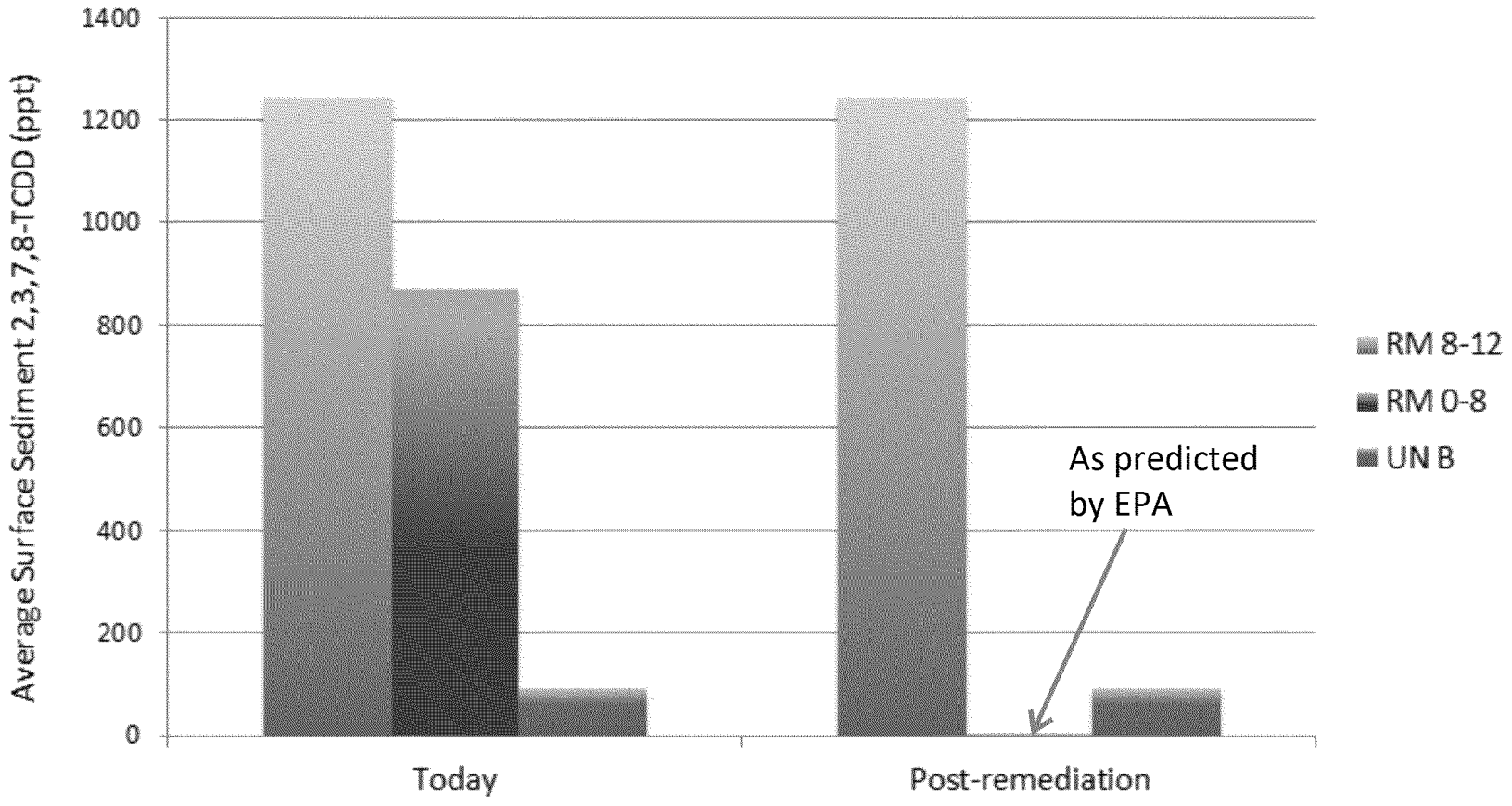
CFT Model Projections

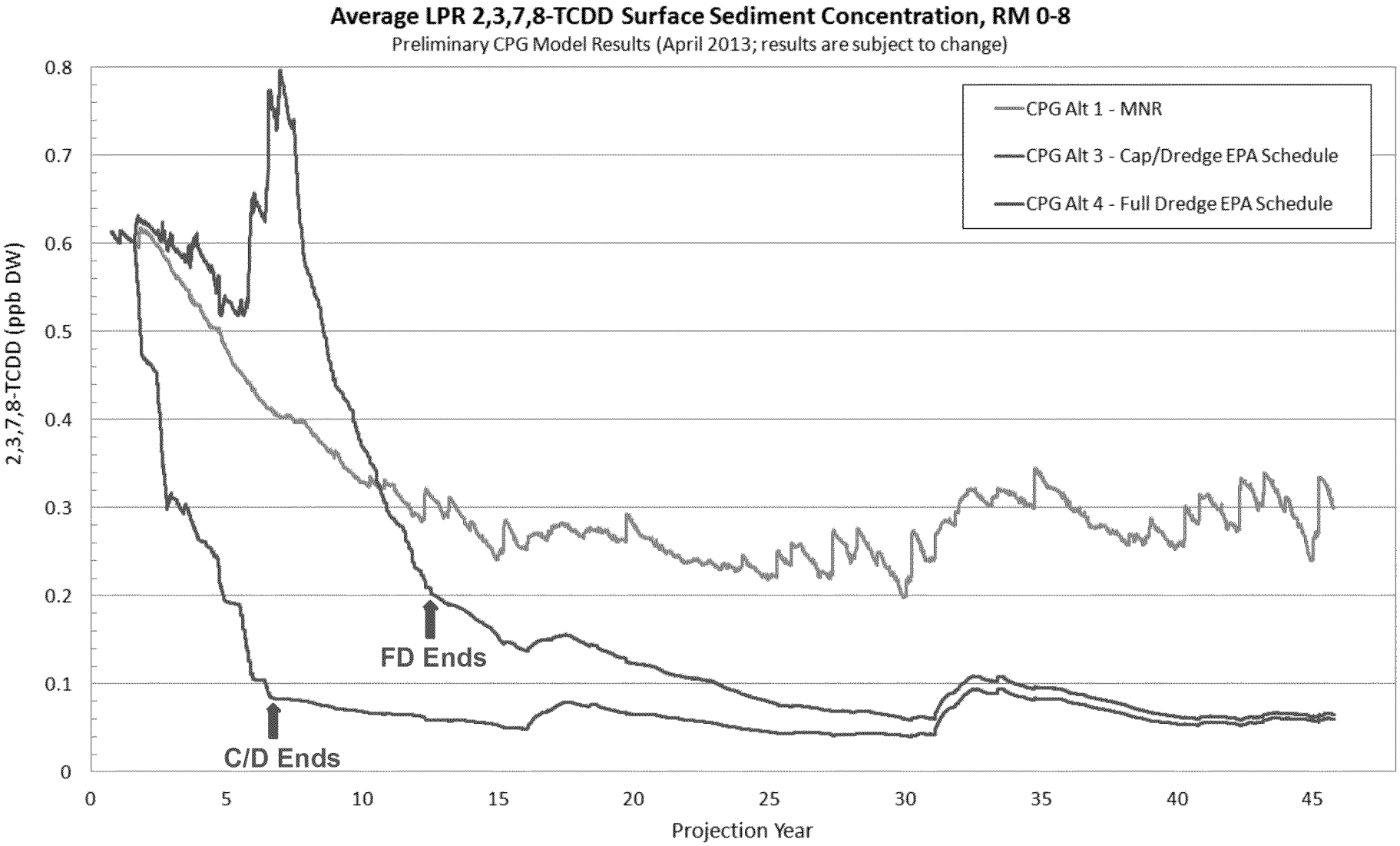
- Plot #1 – EPA Region 2 FFS Presentation
- Plot #2 – Region 2 Alternatives in CPG's model
- Plot #3 – Plot #2 Adjusted for Realistic Duration
- Plot #4 – Comparison with Targeted Remediation



Recontamination of Caps

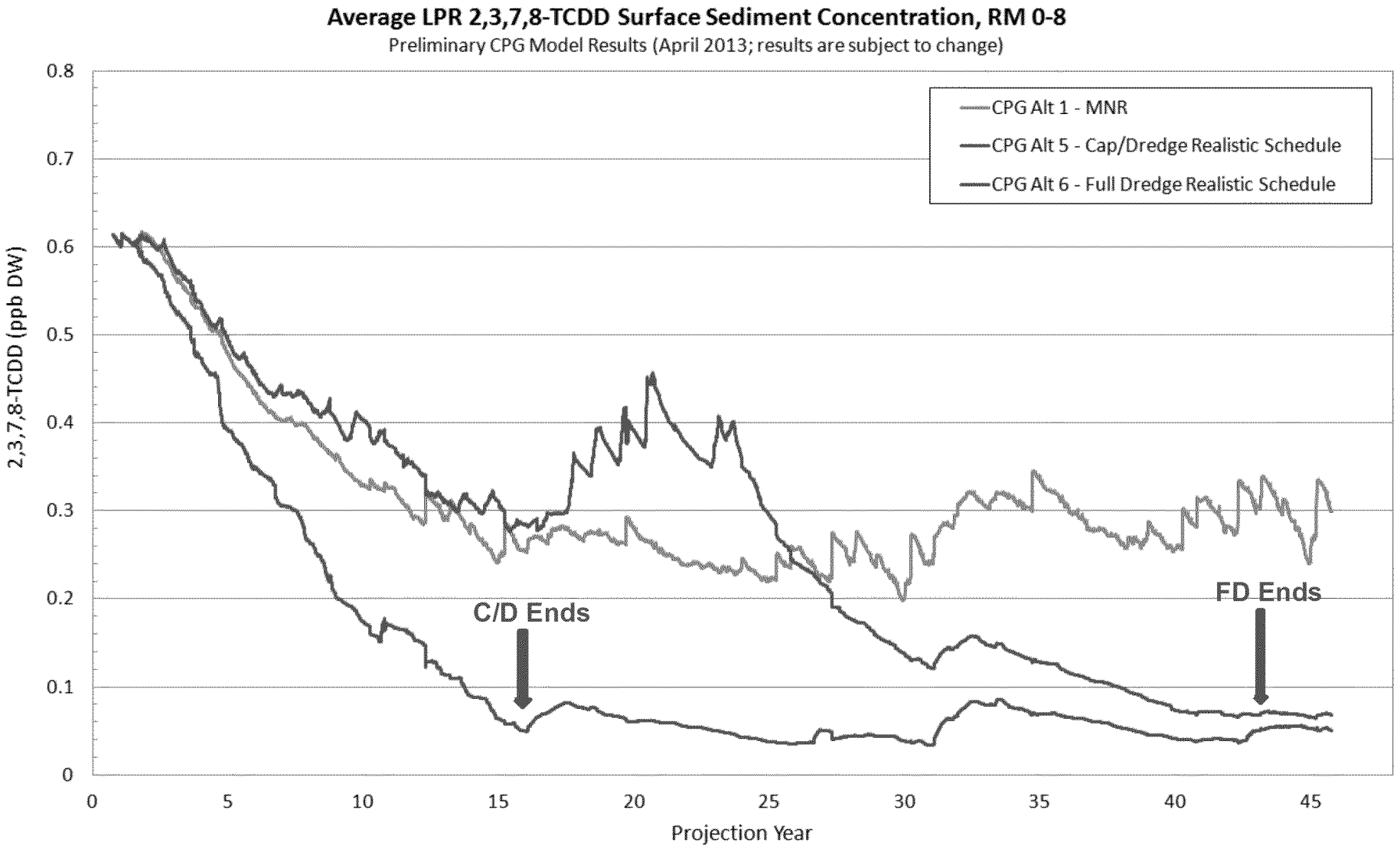
- Contamination Remains Upstream and Downstream of the Remediated Area for Region 2's Alternatives

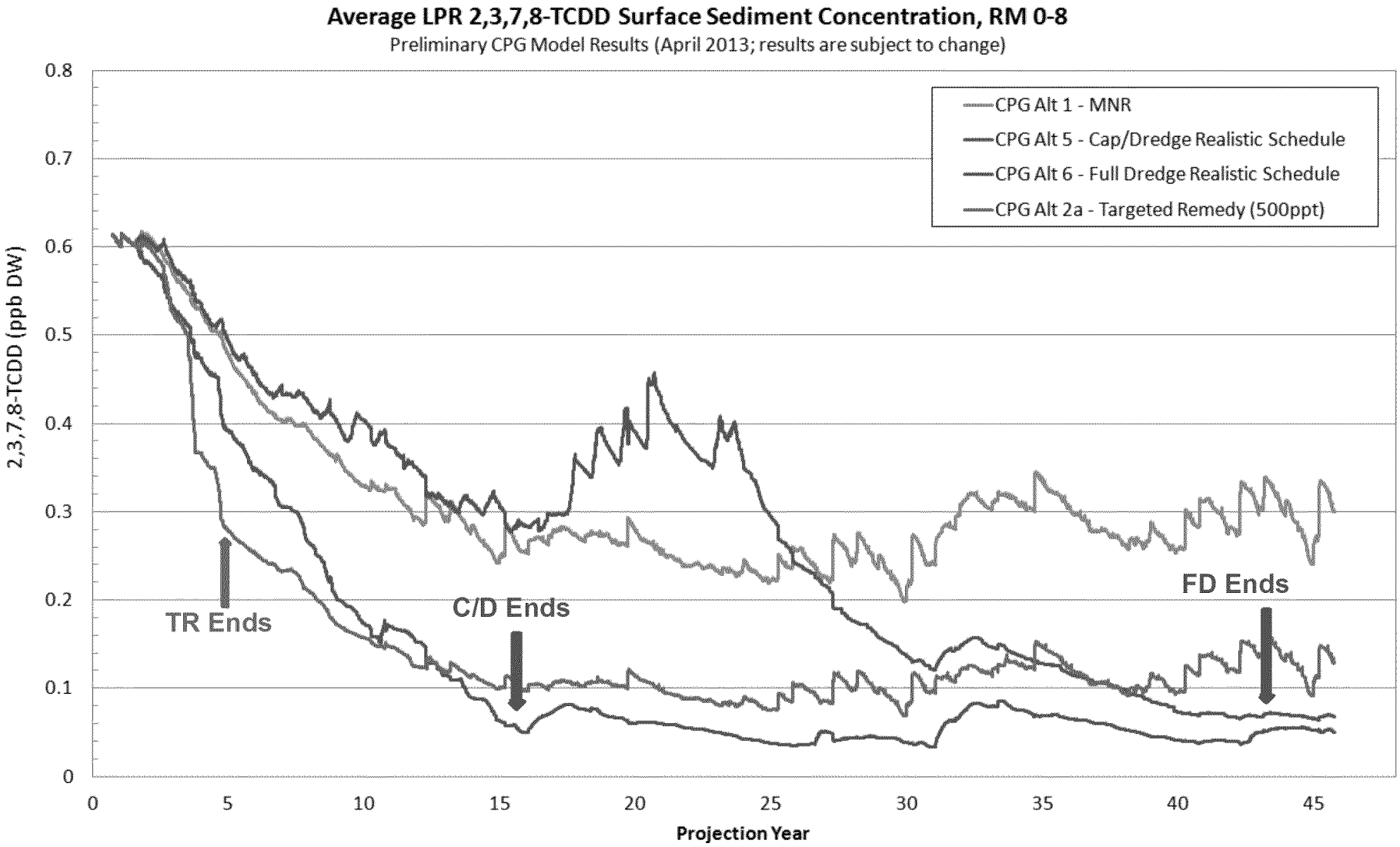


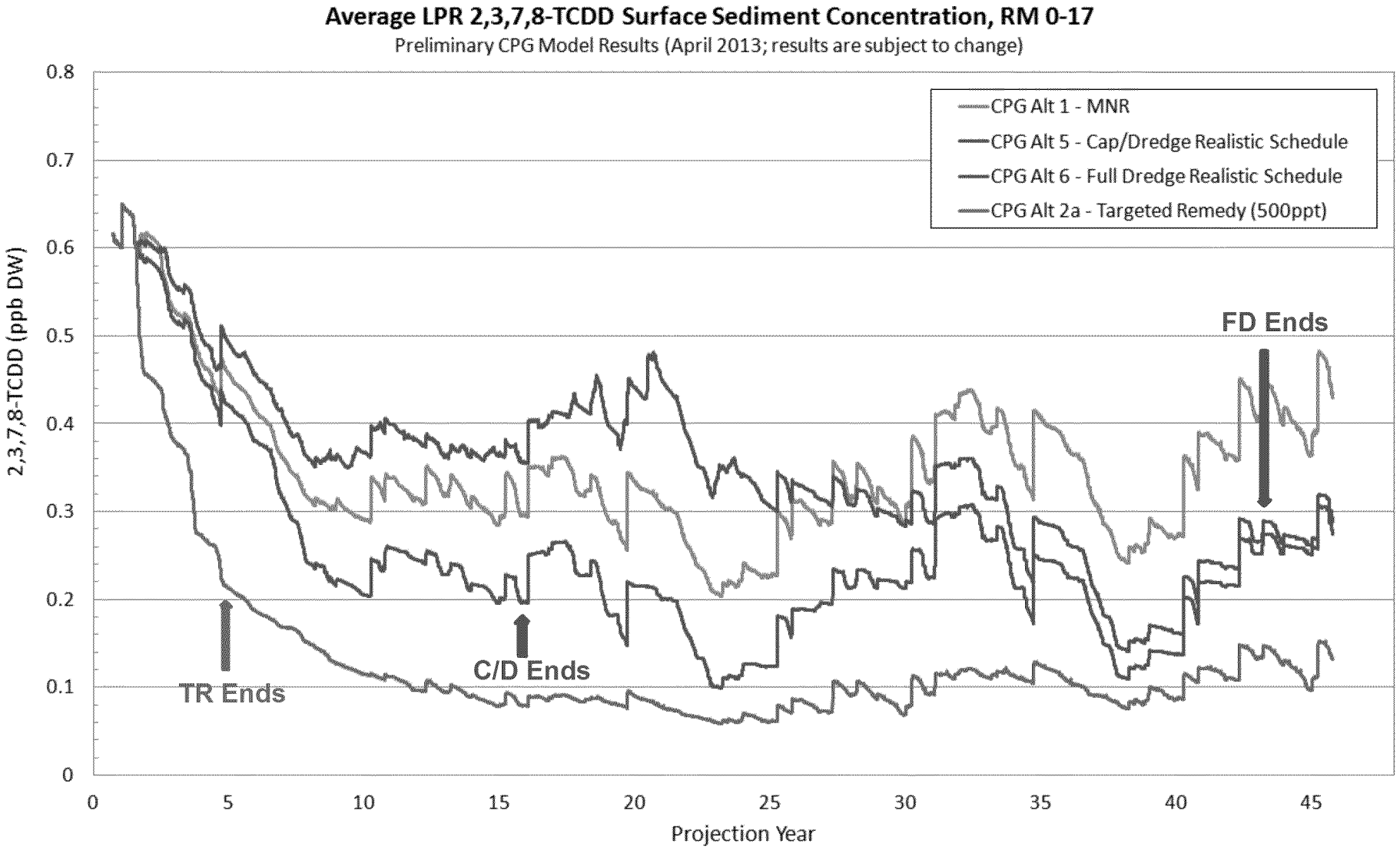


Realistic Project Durations

- Dredging projects in less urbanized river systems have rarely achieved assumed rates:
  - Hudson River: 363,000 cy in 2011 and about 650,000 cy in 2012
  - Fox River: about 500,000 cy/yr
  - Tierra Phase 1 project equates to about 120,000 cy/yr
  - RM 10.9 Removal will equate to about 120,000 cy/yr
- Engineers estimate FFS alternatives to take 17 to 40+ years to complete



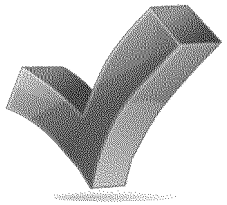
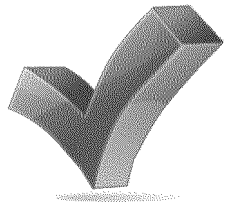
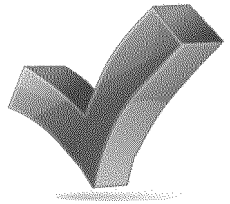
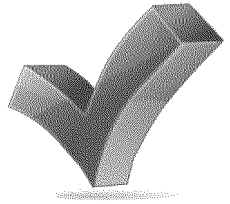




RISK REDUCTION
HUMAN HEALTH & ECOLOGICAL

Human Health
Direct Exposure Risk Reduction

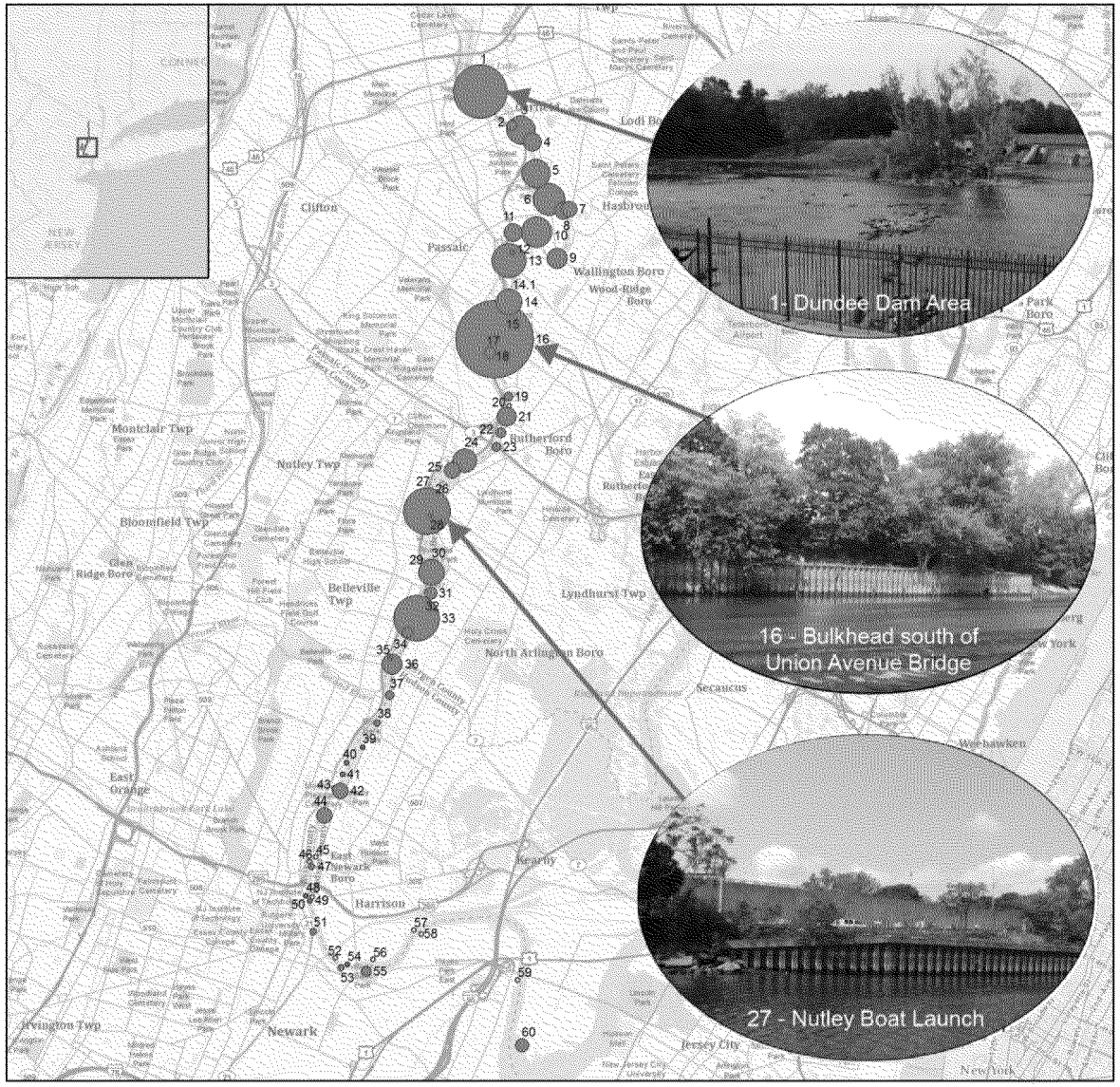
- By focusing on mudflats and nearshore areas with elevated levels of COPCs, targeted remedy rapidly reduces the potential for human exposure
- By removal of target areas, site-wide direct contact risks to waders, swimmers, recreational users, etc. are eliminated
- Sediment remedy does not address risks posed by pathogens
  - Other major source of human health risk in river system

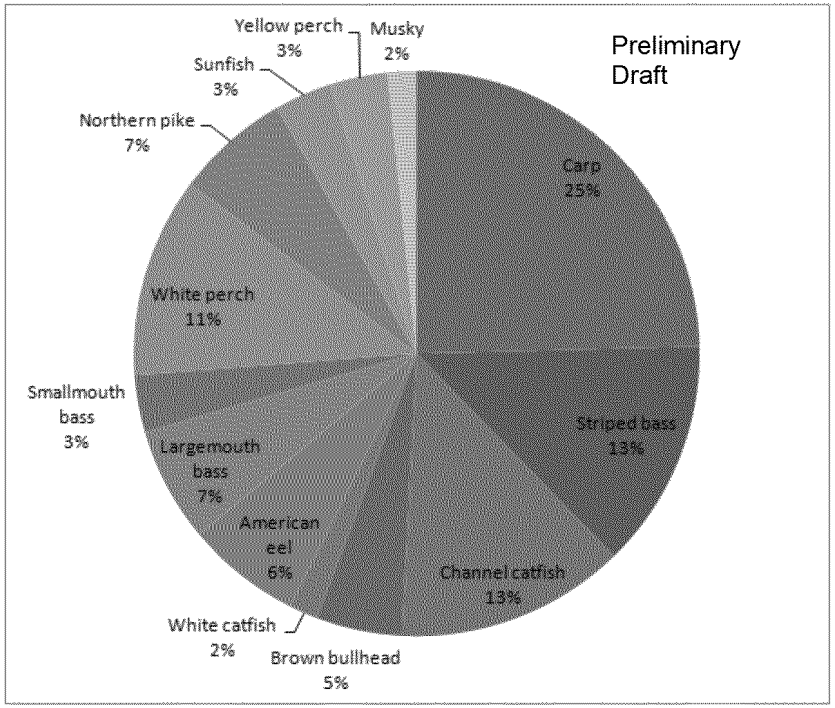
Human Health Exposure Scenarios	Site-wide Risk After Remediation (Target Risk Range)
• Wader	
• Swimmer	
• Boater	
• Worker	
• Angler/ Fish Consumer	**Reduced – Approaches Target Risk Range**

Risks to Angler/Fish Consumer (Informed by CAS)

- Most of risk above target risk range attributed to Carp Ingestion
  - Risk Assessment Assumptions
  - Diet Modifications
- Programs under Consideration to
  - Fish Exchange
  - Carp Eradication/Reduction
  - Local Aquaculture
- Community Education

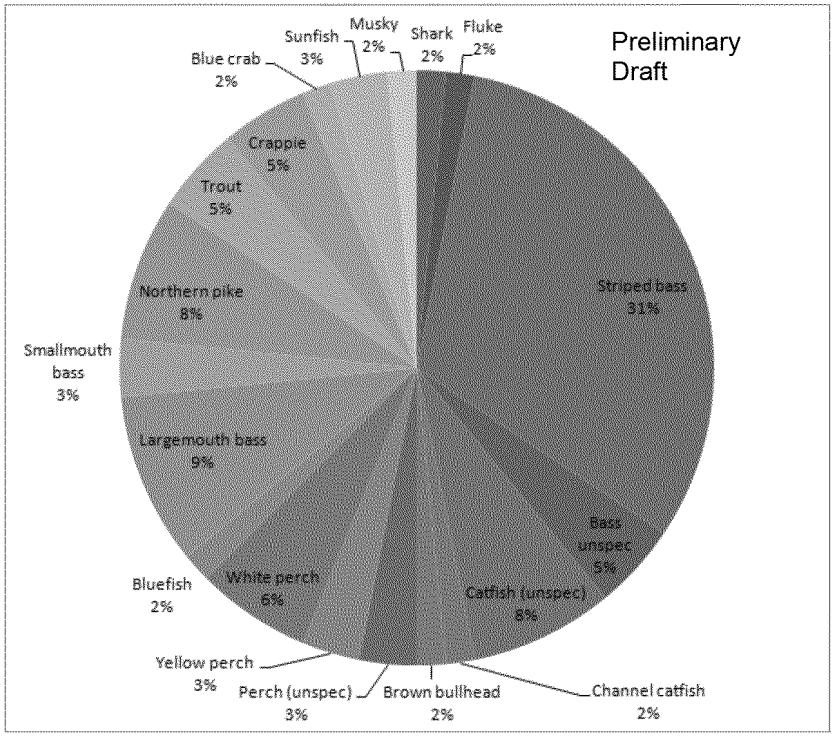
Observed Fishing Locations





Catch Preferences: Current Consumption

(Consuming Anglers)

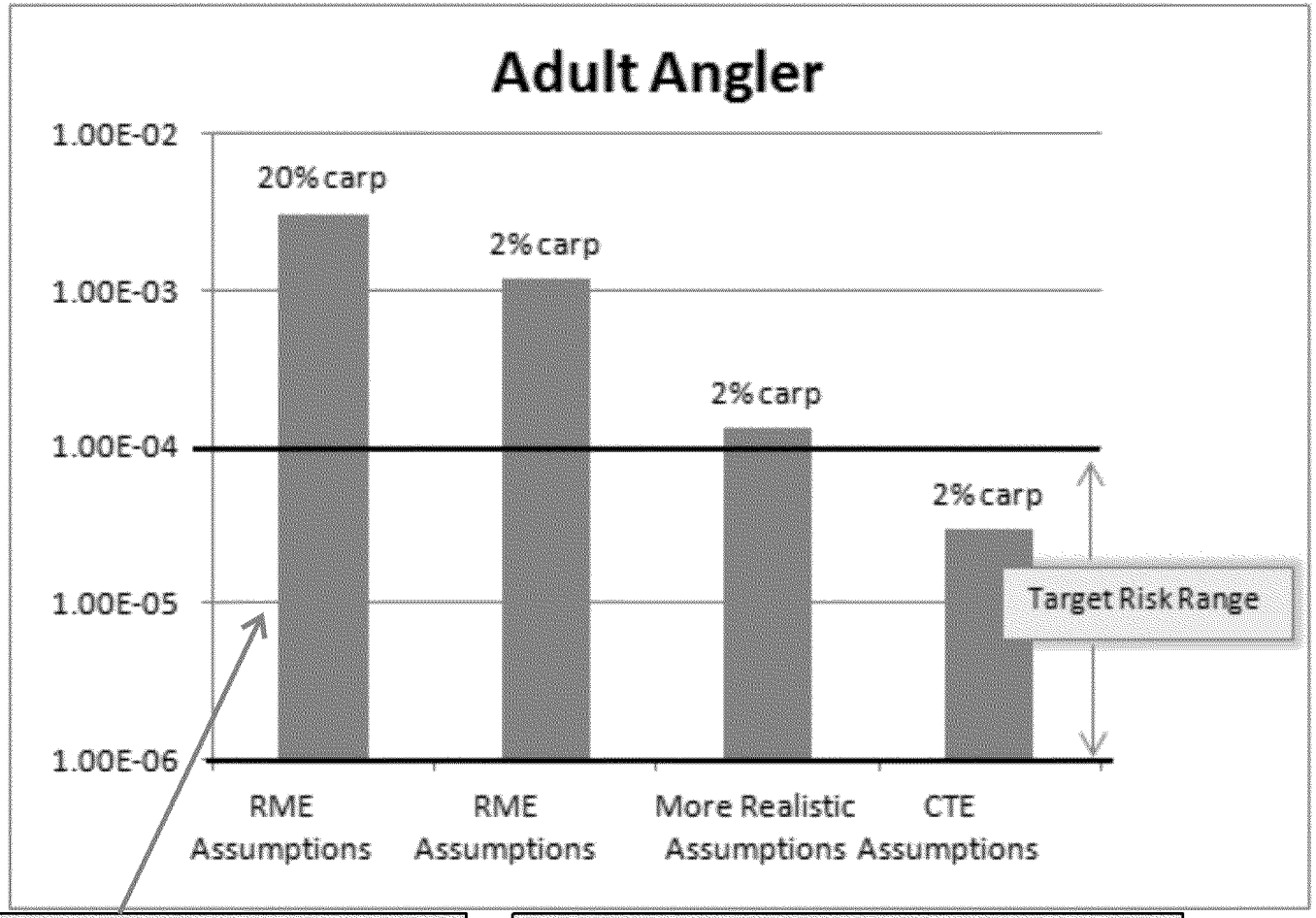


Catch Preferences: But-for-Advisory Consumption

(Consuming and Non-Consuming Anglers)

Impact on Risk

Diet and Exposure Assumption Modifications



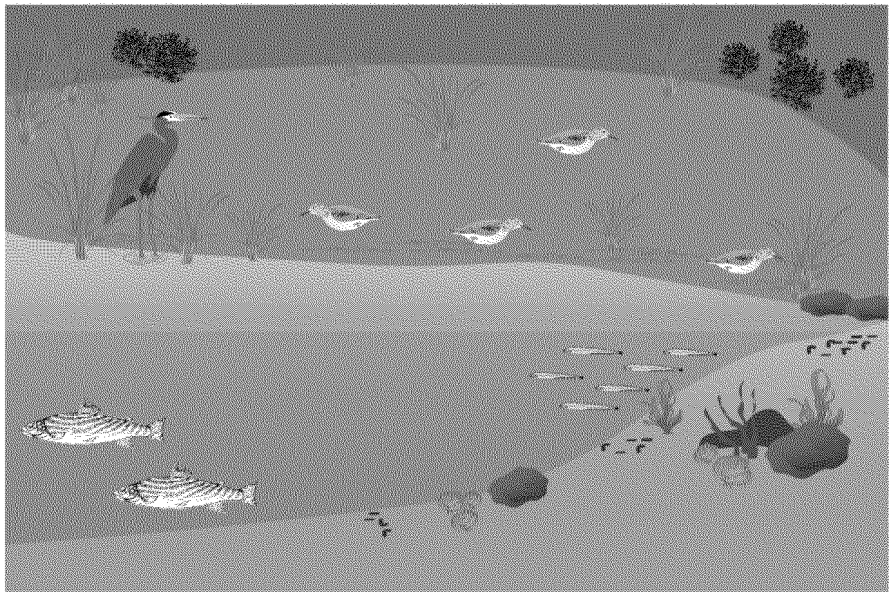
- EPA's RME assumptions: 58 LPRSA fish meals/year for 24 years, and no loss due to cooking
- More realistic assumptions: 28 LPRSA fish meals/year for 9 years, and cooking loss
- EPA's CTE assumptions: 6 LPRSA fish meals/year for 9 years, and cooking loss

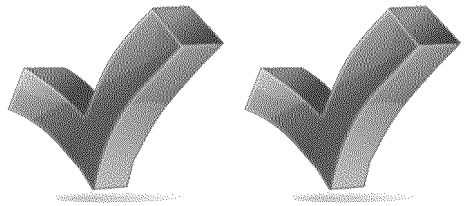
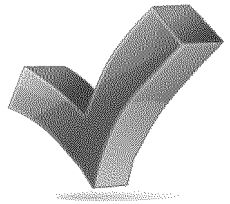
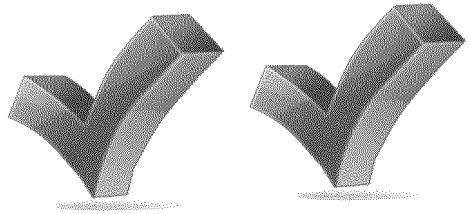
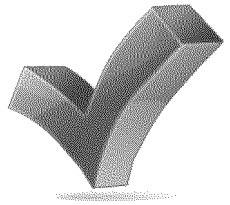
Mixed fish diet with 20% each perch, catfish, bass, eel, and carp

All others - mixed fish diet with 24.5% each perch, catfish, bass, eel, and 2% carp

Ecological Risk: Shoal Habitat

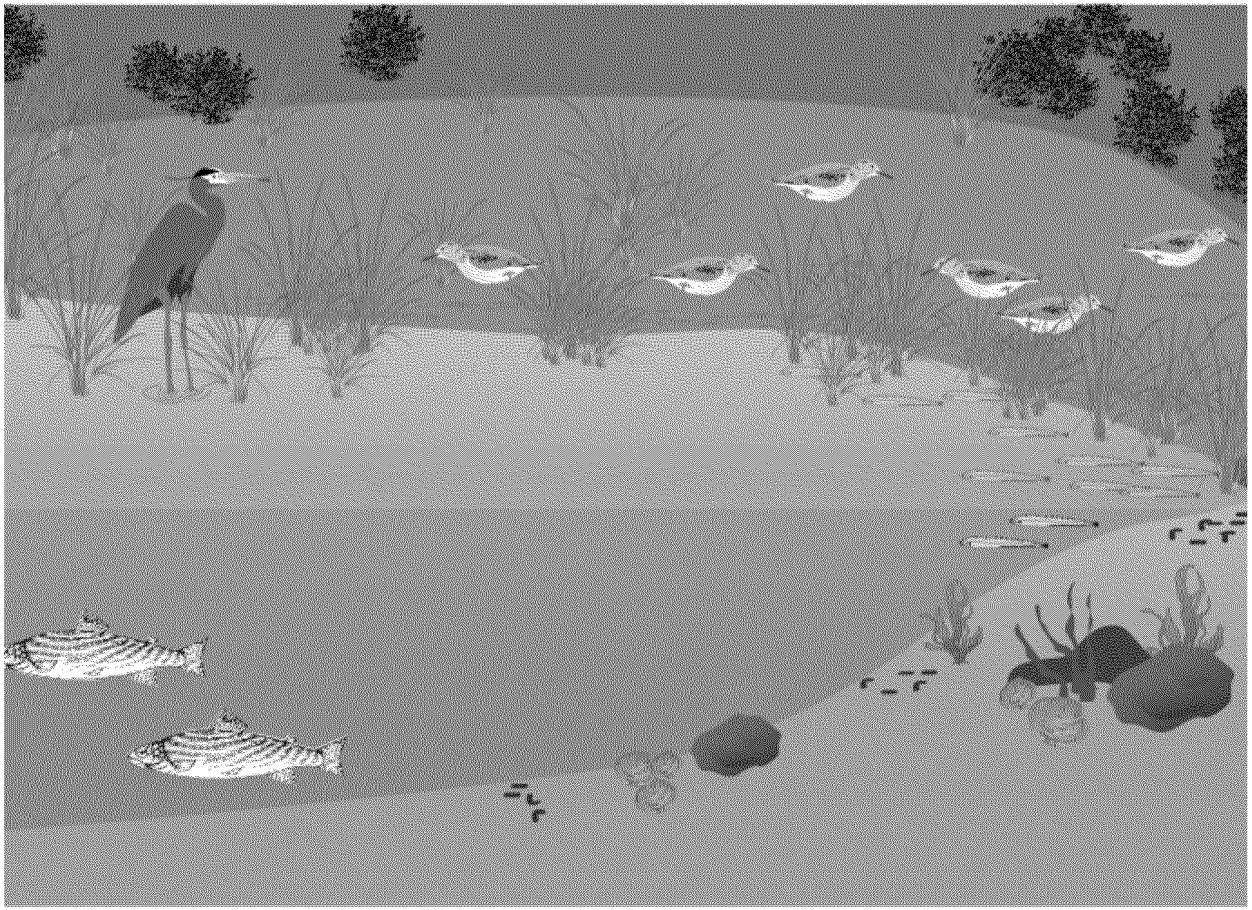
- Typically more productive and ecologically important than deeper river channels
- Represents essential habitat for species such as wading birds
- Represents important habitat for species such as small forage fish



Ecological Exposure Scenarios	Risk After Remediation (HQ<1, HQ<<1)
• Wading Shorebirds	
• Piscivore Wading Shorebirds	
• Other Piscivore Shorebirds	
• Forage Fish	 Reduced

Anticipated Ecological Risk Reductions

- Risks to wading shorebirds that prey on invertebrates (spotted sandpiper) eliminated (HQs << 1)
- Risks to piscivore wading birds that prey on small fish (great blue heron) greatly reduced (HQs < 1)
- Risks to other piscivore birds (belted kingfisher) eliminated(HQs << 1)
- Risks to small forage fish (mummichog and juvenile fish) greatly reduced (HQs < 1)
- Concentrations of chemicals in prey items (invertebrates and forage fish) living in shallow waters reduced



Following Restoration

Because of its significant ecological relevance to the ecology of the lower Passaic River, removal of targeted areas rapidly reduces exposure for many aquatic and aquatic-dependant species, and allows for NRD restoration projects to be implemented quicker.

Ecological Impacts of Carp Population

- Degrade aquatic systems by reducing water quality, vegetated habitat area, and the prey populations of valued fish and wildlife
- Disturb sediment, and increase turbidity
- Destroy vital habitat
- Feed on native fish eggs
- Cause shift to less diverse benthic community

OUT-OF-RIVER COMPONENT

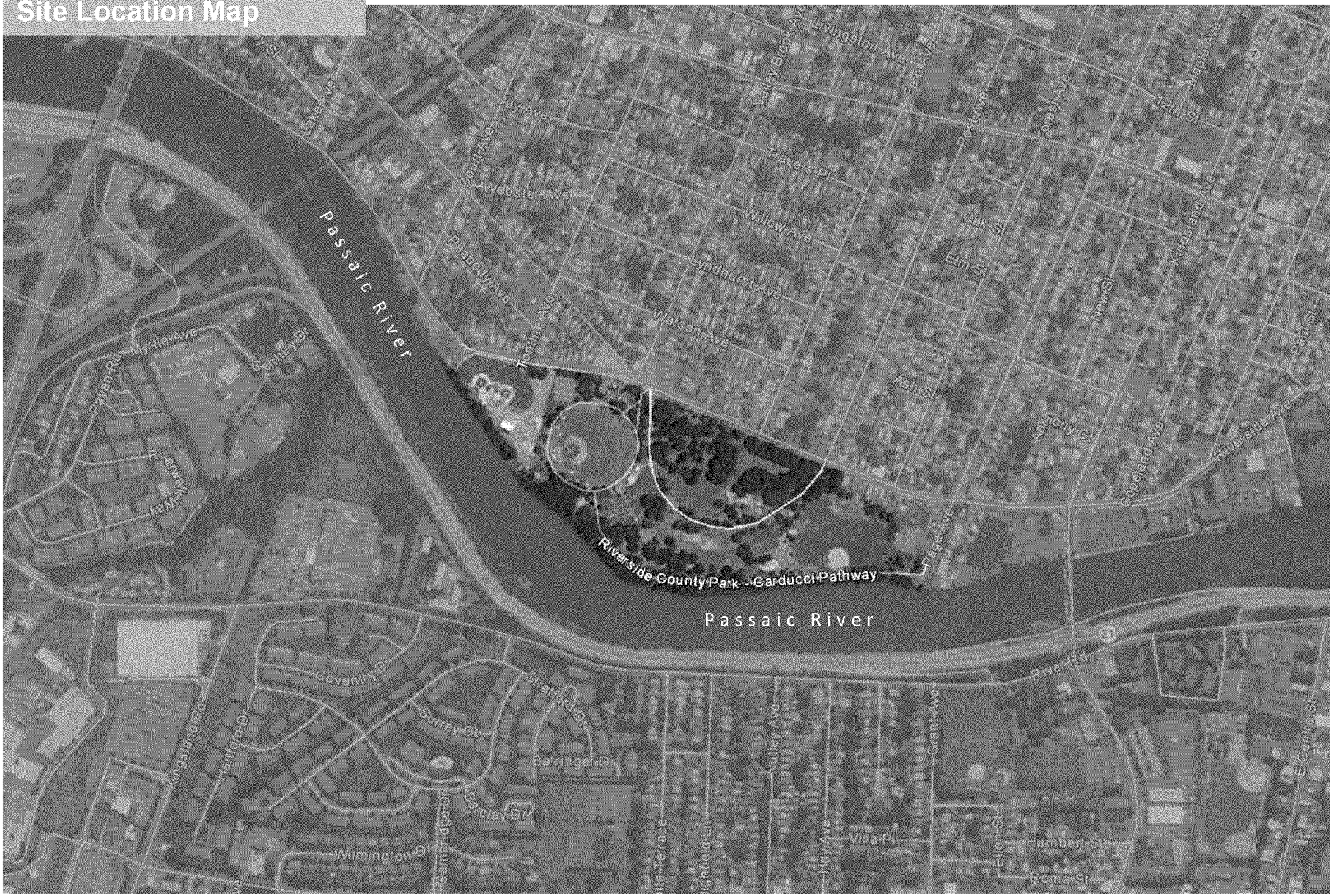
Out-of-River Component

- Focuses on RM 0-17
- Addresses ongoing contamination and “urban river” water quality issues
- Includes projects, such as wetlands restoration, steps to reduce urban runoff, new parks, and improved access points
- Incorporates input from River communities
- Community Education Programs

Example

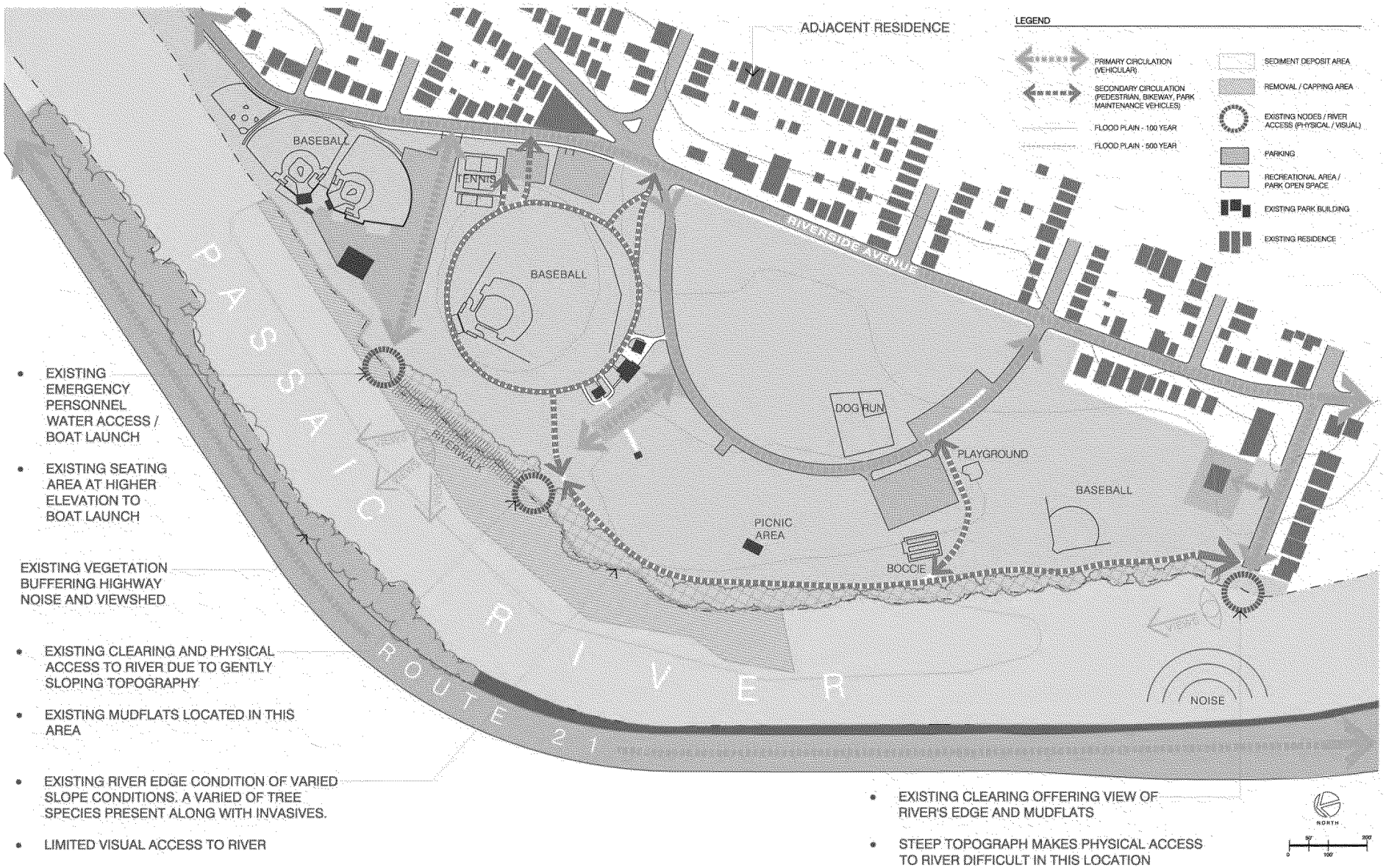
LYNDHURST PARK CONCEPTUAL DESIGN

Site Location Map



Source: Google Maps

Site Analysis Plan



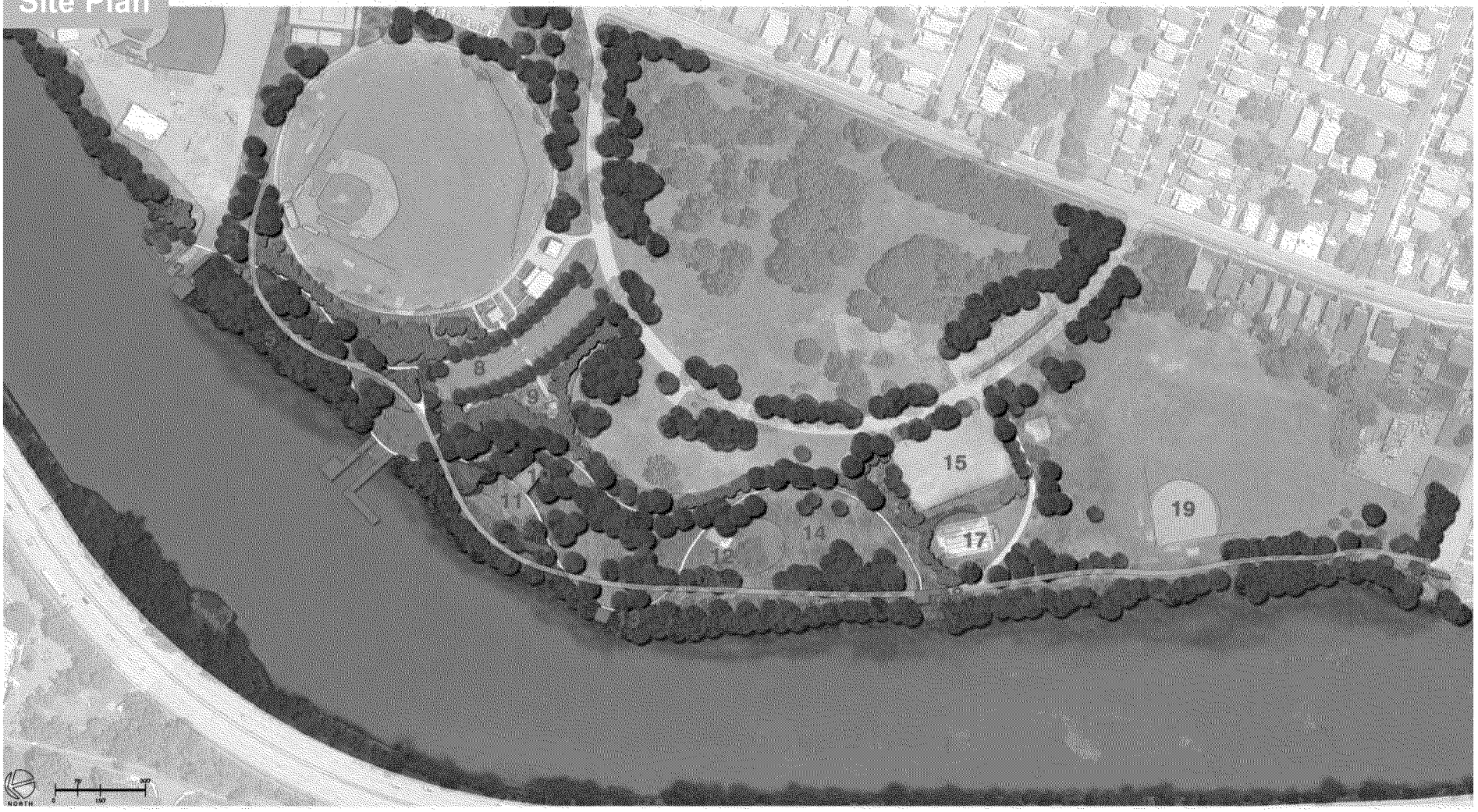
- EXISTING EMERGENCY PERSONNEL WATER ACCESS / BOAT LAUNCH
- EXISTING SEATING AREA AT HIGHER ELEVATION TO BOAT LAUNCH

EXISTING VEGETATION BUFFERING HIGHWAY NOISE AND VIEWSHED

- EXISTING CLEARING AND PHYSICAL ACCESS TO RIVER DUE TO GENTLY SLOPING TOPOGRAPHY
- EXISTING MUDFLATS LOCATED IN THIS AREA
- EXISTING RIVER EDGE CONDITION OF VARIED SLOPE CONDITIONS. A VARIED OF TREE SPECIES PRESENT ALONG WITH INVASIVES.
- LIMITED VISUAL ACCESS TO RIVER

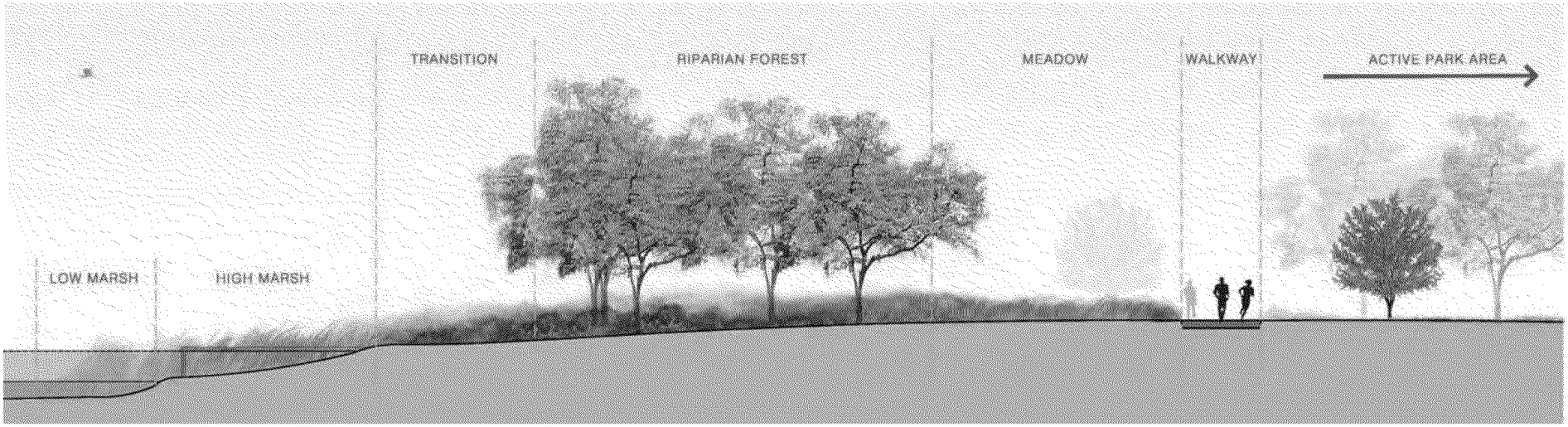
- EXISTING CLEARING OFFERING VIEW OF RIVER'S EDGE AND MUDFLATS
- STEEP TOPOGRAPH MAKES PHYSICAL ACCESS TO RIVER DIFFICULT IN THIS LOCATION

Site Plan



1. AMPHITHEATER SEATING STEPS NORTHERN RIVERWALK TERMINUS
2. PUBLIC BOAT LAUNCH RAMP AND FLOATING DOCK (CURRENTLY EMERGENCY OFFICIAL USE ONLY)
3. RIVERWALK (PRIMARY PATHWAY)
4. RIVERWALK (SECONDARY PATHWAY, PEDESTRIAN USE) WITH LEARNING NODES PERMEABLE PAVEMENT.
5. REGENERATED RIPARIAN FOREST HABITAT
6. (REGENERATED RIVER BRIDGE) TIDAL MARSH HABITAT (LOW + HIGH)
7. SMALL WATERCRAFT BOAT LAUNCH AND FLOATING DOCKS
8. RECONFIGURED PARKING LOT (EXTENDED AREA AND PERMEABLE PAVEMENT)
9. EVERGREEN BUFFER SCREENING EXISTING UTILITIES AND STORAGE BUILDING
10. ENVIRONMENTAL EDUCATION CENTER
11. OPEN LAWN / GATHERING SPACE
12. EXISTING PICNIC PAVILION WITH TABLES
13. BOARDWALK OVERLOOK
14. UPLAND MEADOW HABITAT
15. EXISTING PARKING LOT
16. STORMWATER TREATMENT / WET MEADOW HABITAT
17. EXISTING BOCCIE COURTS
18. BRIDGE AND BOARDWALK OVERLOOK
19. EXISTING BASEBALL FIELD
20. OVERLOOK / SOUTHERN RIVERWALK TERMINUS

Sections of Proposed Zone Design



ZONE 1

Boat Launch

ZONE 1

METHODS TO ADDRESS UNCERTAINTY

Elements to Actively Address Uncertainty

- Adaptive Management
- Fish Exchange
- Community Education
- Sustainable Development

Sustainable Remedy Based on "Adaptive Management"

Design

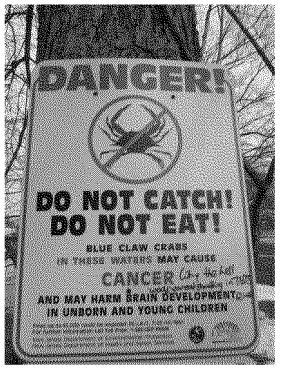
How do you best address uncertainty?

Information to measure success and support future decision-making

- Post-remedy monitoring to measure effectiveness
  - Fish tissue
  - Ecology
  - Bathymetry
- Need to demonstrate success to EPA and stakeholders
- Open dialogue with regulators

Fish Exchange

- "Active" substitution to "passive" fish advisory
  - Source of safe, high-quality protein
  - Eliminate risk pathway



- Economic development
  - Jobs for under-employed, veterans & ex-offenders
  - Rutgers University experts supporting development of programs
- Education
  - Connecting communities with the river
  - Science/technology education

Sustainable Development

- Provides platform for all stakeholders
- Consistent with Urban Waterways Initiative
- Provides ecological, economic and social value

Sustainable Remedy is Protective

- Consistent with EPA Guidance
  - Sediment Management Principles
  - Uses Adaptive Management to assure success
- Addresses entire river
- Is protective
  - Will Meet Risk Reduction Goals
  - Removes high concentration areas
  - Minimizes re-suspension of COCs
  - Manages interim risks
- NCP Process – Lowest Cost Alternative that is Protective
- Reduces duration/disturbance of River
- Enhances the natural recovery rates of the River